As discussed from the bottom of page 2 of the application, an all optical switch addresses the problem of electronic bandwidth, but has difficulty performing the logic needed to route packets or providing the memory required for packet buffering. Also, optical switches typically switch very slowly. In accordance with the present invention, an optical switch operates with a schedule which allows for much slower switching than would be required if the routing were directly determined by the input packets. Reordering units rearrange the order of the data units within data streams to correspond to the schedule of the switch, thus allowing the packets to be appropriately matched to the switch schedule for appropriate routing.

With respect to claims 1, 13, and 25, the Examiner is of the opinion that Shively teaches all of the claimed features except for an optical switch. Lahat is cited to show the use of an optical switch and contends that one skilled in the art would have been motivated to incorporate the optical switch of Lahat with the T-S-T switch of Shively. We respectfully disagree.

There is no suggestion to combine Shively with Lahat. Moreover, the Applicant contends that one skilled in the art would have no expectation of success with such a combination because the slow-switching frequency-tuned space switch of Lahat is not compatible with the time-space-time switching of Shively.

In particular, the switch of Shively is a T-S-T (time-space-time) switch. As described in Figures 3 and 6, and columns 9 and 10, such a switch exchanges data in both space (*i e.*, across the ports) and in time (*i.e.*, between time slots). To operate the Shively space switch (item 61 in Figure 6), permutations must be switched on every time slot. Typically a time slot is made very short (e.g., one byte in a SONET system) since making the time slot large causes the TSI memories (83 and 85 in Figure 7) to become prohibitively large. Thus, the slow configuring frequency-tuned optical switch of Lahat could not be used in the system of Shively since it would require the time slots of the T-S-T switch to be very long (*e.g.*, longer than the configuration time of the optical switch) and hence would require prohibitively large memories in the TSI. The Applicant also points out that the TSI in the Avici system is not being used to switch inputs in

time, but is rather used to batch packets going to the same output together, which is a very different function.

Another key aspect of the invention, which is not suggested by Shively or Lahat, is that the switch is operated using a schedule that is not directly determined from the input stream but which takes into account unbalance in traffic such as indicated by the average load between each input/output pair. In particular, when unbalanced traffic arrives at a packet switch, input queues can grow to become unbalanced. The present invention solves this problem by adapting the schedule of the optical switch in response to this growth in queues to correct this unbalance. As recited in claims 1 and 13, "the schedule of the optical switch [is] changed to have unbalanced periods in response to unbalance in traffic." This indirect control, while still allowing response to unbalanced traffic, greatly simplifies the task of switch scheduling and control and is a major improvement over the prior art. Neither Shively nor Lahat discloses schedule adaptation of any kind.

Unlike the packet switch of the present invention, Shively and Lahat disclose circuit switches. Circuit switches operate on a predetermined, fixed schedules and do not respond to changes in traffic volume at all. Rather, circuit switches simply switch input data streams according to their pre-arranged schedules. Such schedules can be changed in response to call setup and teardown messages. However, this occurs before any traffic reaches the switch, resulting in no unbalance in queue length or link loads once traffic starts to flow. Thus, the schedules of Shively's and Lahat's switches are not "changed to have unbalanced periods in response to unbalance in traffic." The Examiner does not address this limitation of changing schedules in claims 1, 13, and 25.

Other claims are also not suggested by this combination. Regarding claims 2, 5, 14, and 17, the time-space-time switch of Shively is not equivalent to a crossbar or to a multi-stage interconnection network. There is no suggestion in Shively to use such a network. Nor would such a network be appropriate to the system of Shively where the switch must switch data in time as well as space, which a crossbar or multistage network cannot do.